Impact of the storm-time electrodynamics on the coupled ionosphere-plasmasphere-thermosphere system

Naomi Maruyama

Cooperative Institute for Research in Environmental Sciences, University of Colorado
and Space Environment Center, NOAA

Abstract:
Elucidating the storm-time disturbances in the terrestrial ionospheric electric fields requires the two principle mechanisms: prompt penetration and disturbance dynamo. In order to investigate the storm-time interaction between the two sources and the role of the electrodynamics in restructuring the ionosphere, plasmasphere and thermosphere, we have combined the two first-principles models: the Rice Convection Model (RCM) used to calculate inner magnetospheric electric fields, and the Coupled Thermosphere Ionosphere Plasmasphere electrodynamics (CTIPe) model driven, in part, by the RCM-computed electric fields. As compared to the historical picture of prompt penetration, our model results suggest the possibility that penetration effects can have a longer time scale when the IMF Bz is large and negative as a consequence of the ineffective shielding resulting from the magnetospheric reconfiguration. Furthermore, our simulations indicate that the arrival of the disturbance dynamo effect in the low latitude ionosphere can possibly be faster than the previously believed, as the disturbance dynamo is modified by the changes in the electrical conductivity and neutral wind initiated by the penetration effect. Comparison of the results from the combined models with observations demonstrates that our models are capable of reproducing many of the observed features in the ionosphere.

Brief bio:
Dr. Naomi Maruyama has a PhD in Geophysics from Hokkaido University, Japan. She worked as a postdoctoral fellow at High Altitude Observatory (HAO), NCAR in Boulder Colorado. Currently she works at Space Environment Center (SEC), NOAA, as a research associate in Cooperative Institute for Research in Environmental Sciences (CIRES), University of Colorado. Her scientific interests include numerical modeling of the terrestrial ionosphere, plasmasphere, thermosphere, and electrodynamics. In particular, she has been developing the models of the ionospheric electrodynamics and plasmasphere with a main focus on their coupling to the magnetosphere.